

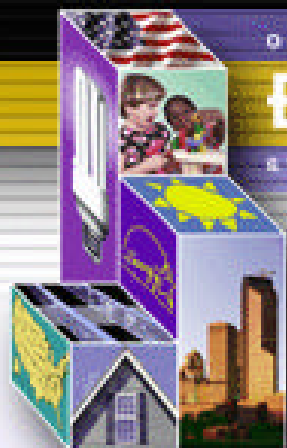
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**BUILDING** TECHNOLOGY

STATE AND COMMUNITY PROGRAMS

# To 2020 and Beyond: A Future of Whizbang Building Technologies & Practices

Mark Ginsberg  
Deputy Assistant Secretary  
Office of Energy Efficiency  
and Renewable Energy,  
U.S. Department of Energy



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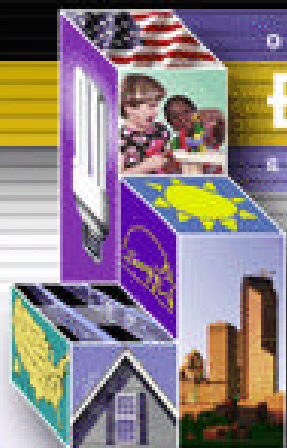
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## Why Buildings Matter

... our nation spends \$240+ billion each year on energy for buildings ...

... productivity and comfort can be enhanced by energy efficiency...

... one-third of U.S. pollution is caused by energy use in buildings ...

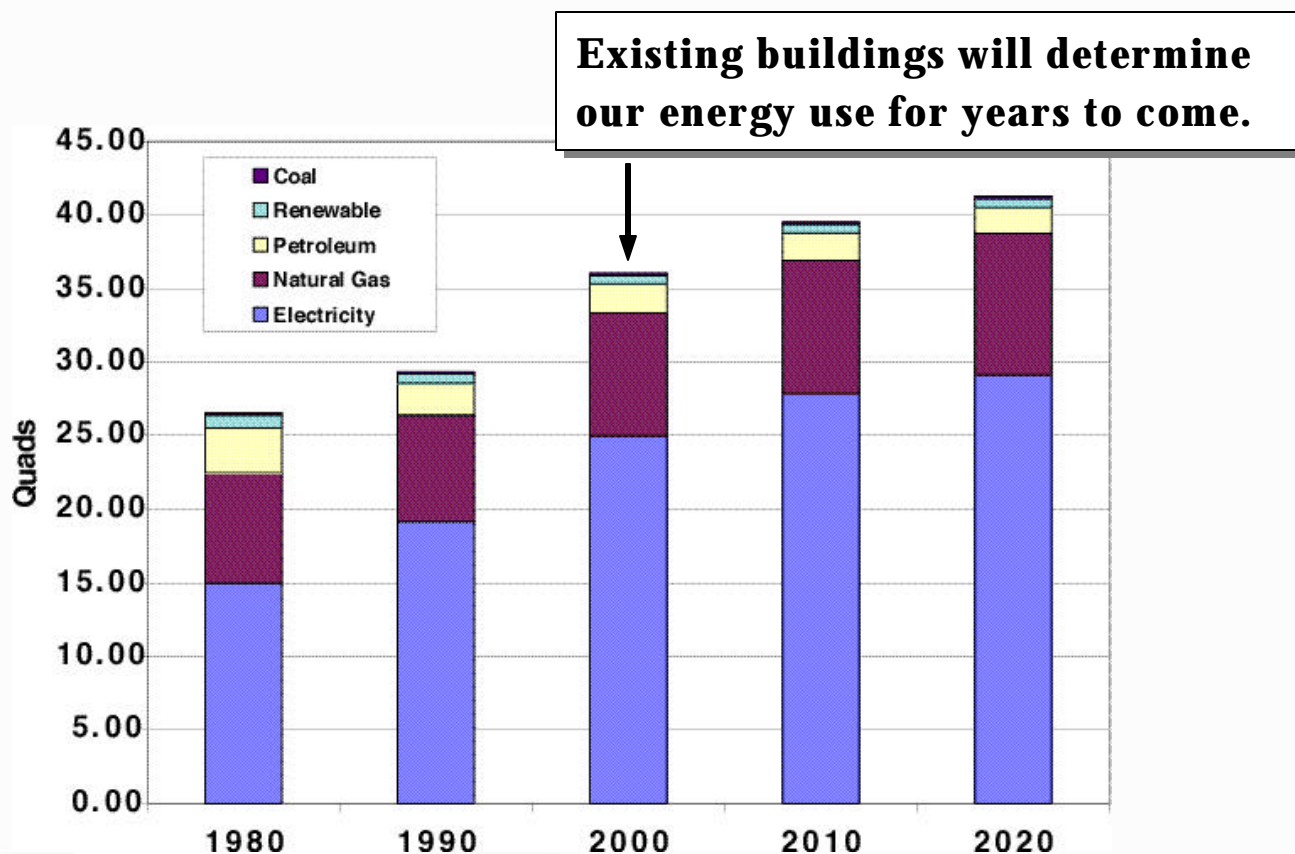


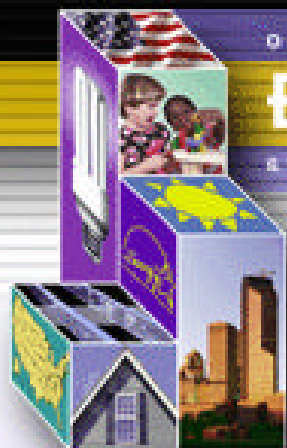
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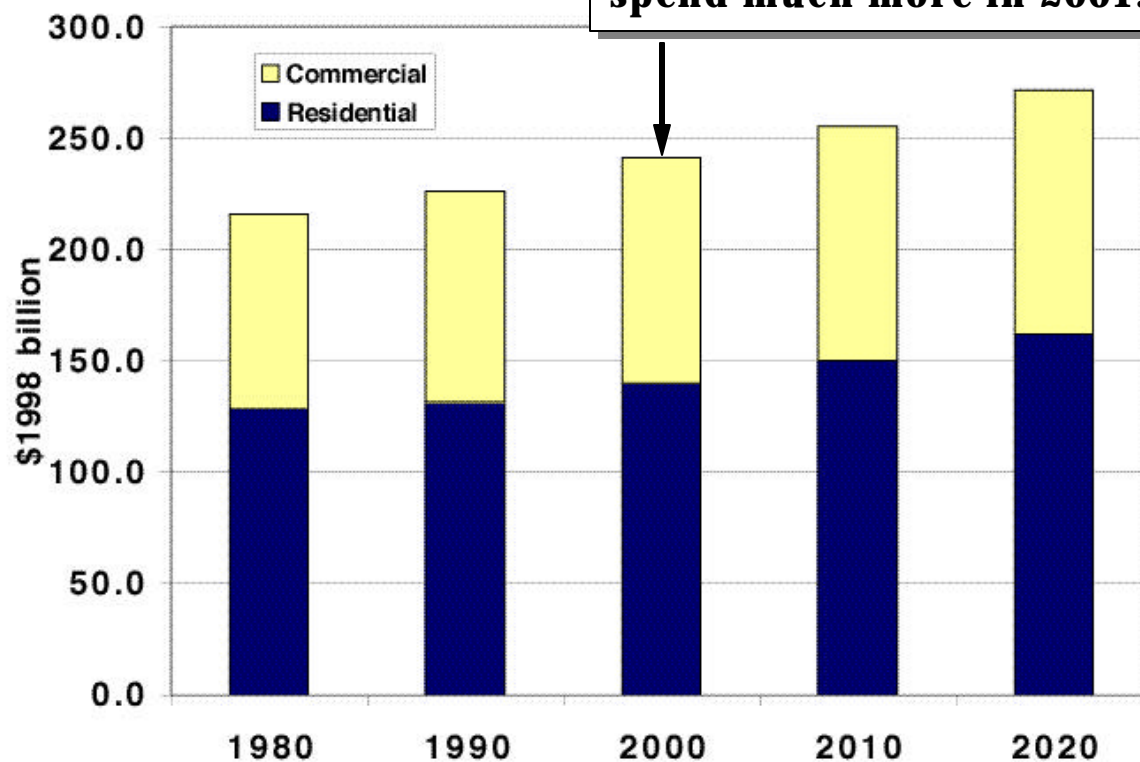
# Projected U.S. Buildings Energy Consumption

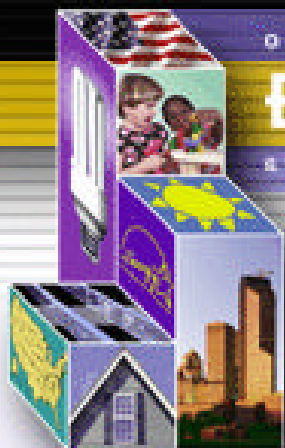




# Buildings Energy Expenditures

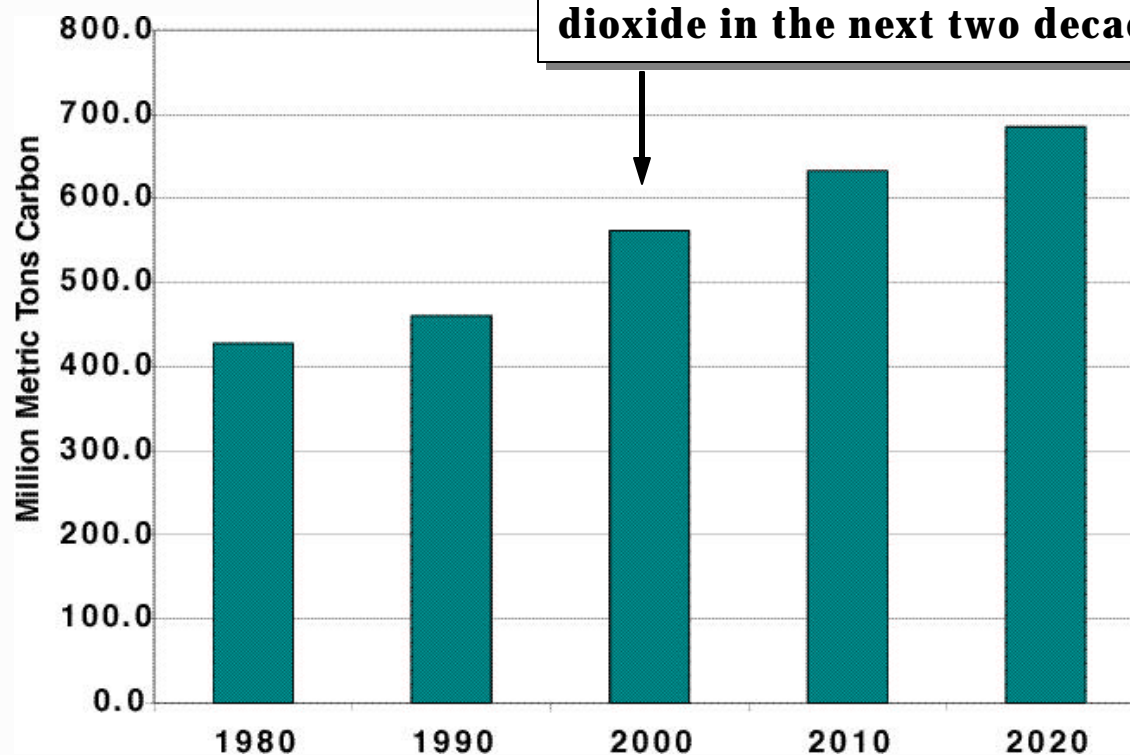
**The average U.S. household spent \$1,300 on home energy in 2000 and will spend much more in 2001.**

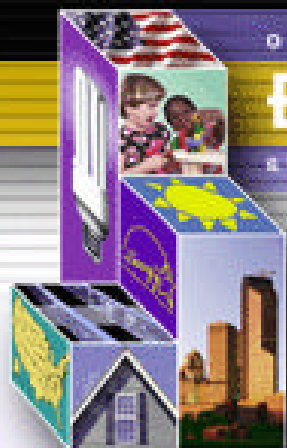




# U.S. Buildings Carbon Emissions

**U.S. homes and buildings are expected to add the equivalent of the United Kingdom to world emissions of carbon dioxide in the next two decades.**





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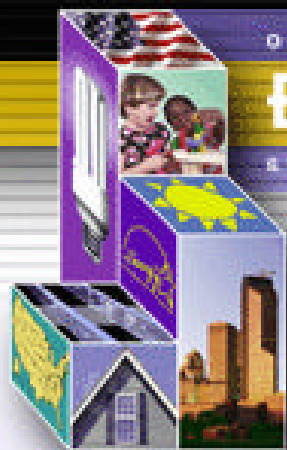
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# Technological Approaches

## Systems Integration

- Existing Buildings
- New Buildings
- Whole Communities





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## Systems Integration

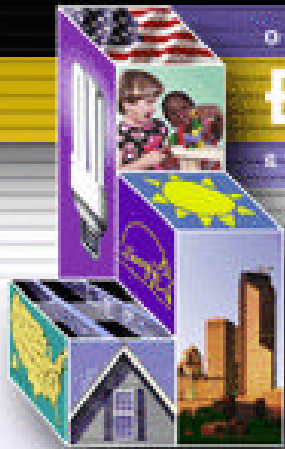
### Existing Buildings: Enhanced HVAC Diagnostic Procedures



- Check refrigerant charge
- Check air flow
- Check ducts for leaks & insulation
- Check distribution temp.
- Check system balancing



will facilitate . . .



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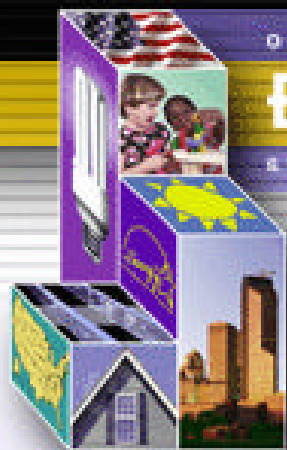
## Systems Integration

### Integrated HVAC Repair and Replacement

- Install high-efficiency compressor
- Fix duct leaks & add insulation
- Correct unit sizing
- Correct refrigerant charge
- Verify system performance







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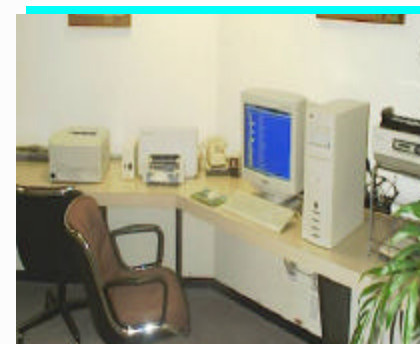
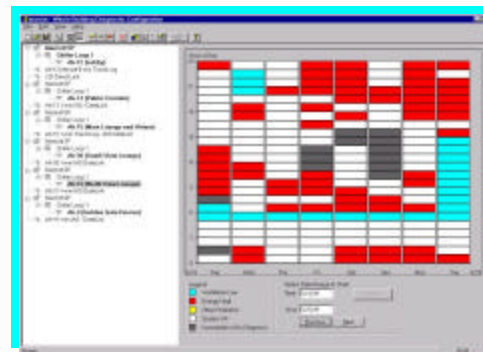
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Systems Integration

# Whole Building Diagnostician

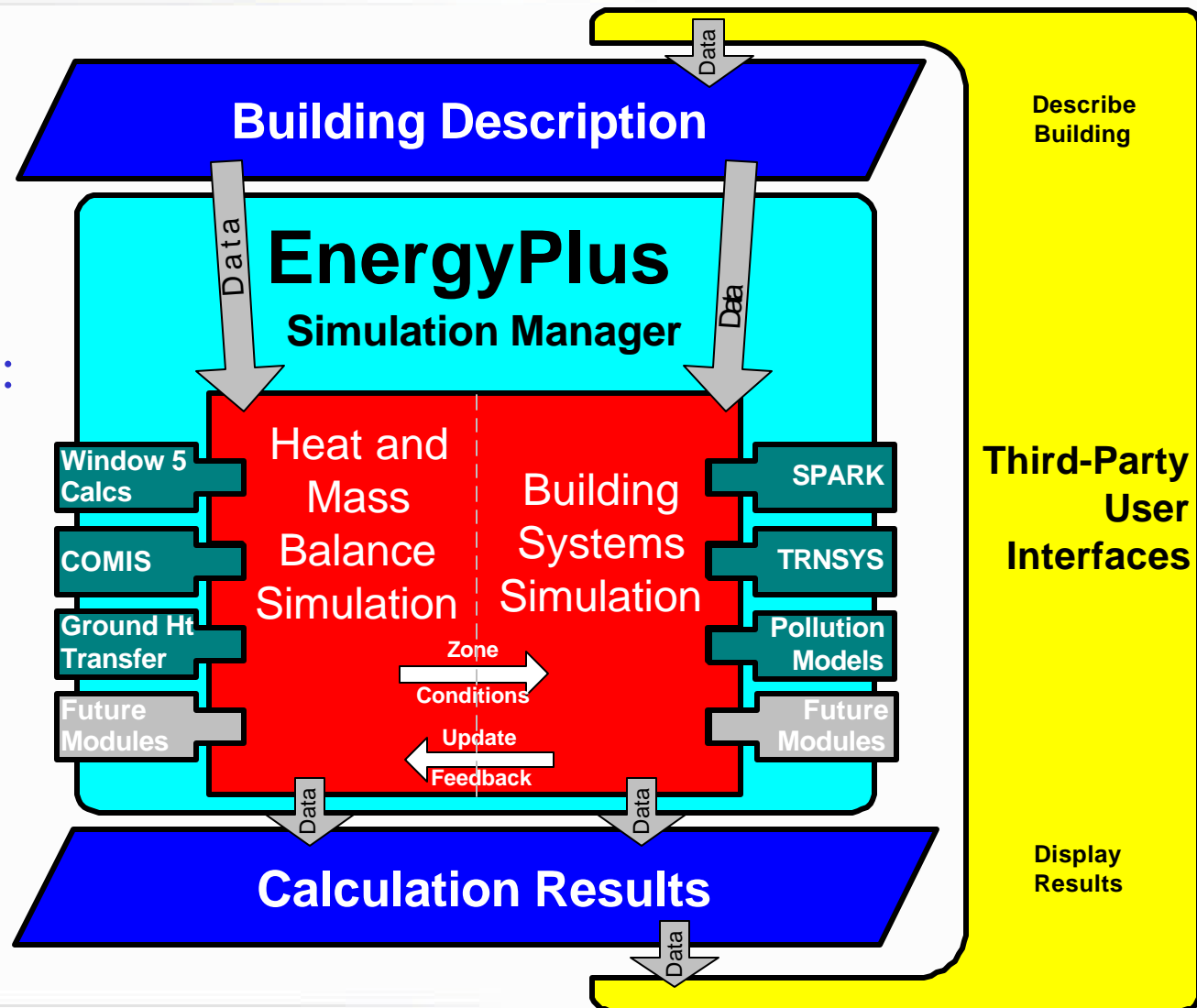


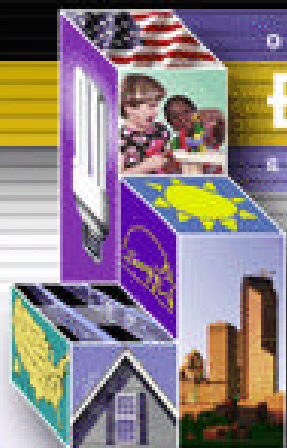
- Detects changes in energy consumption of whole buildings and major building systems
- Identifies and diagnoses operating problems with outside-air ventilation and economizer control
- Estimates impacts on energy costs





**EnergyPlus:**  
A building  
energy  
simulation tool





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Systems Integration

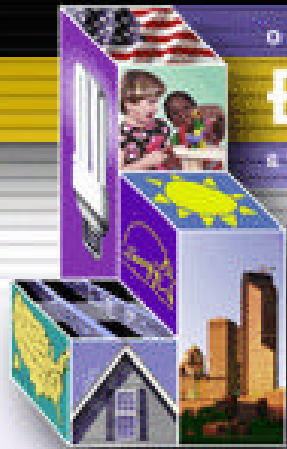
## New Buildings



4 Times Square



Southface Energy  
Institute



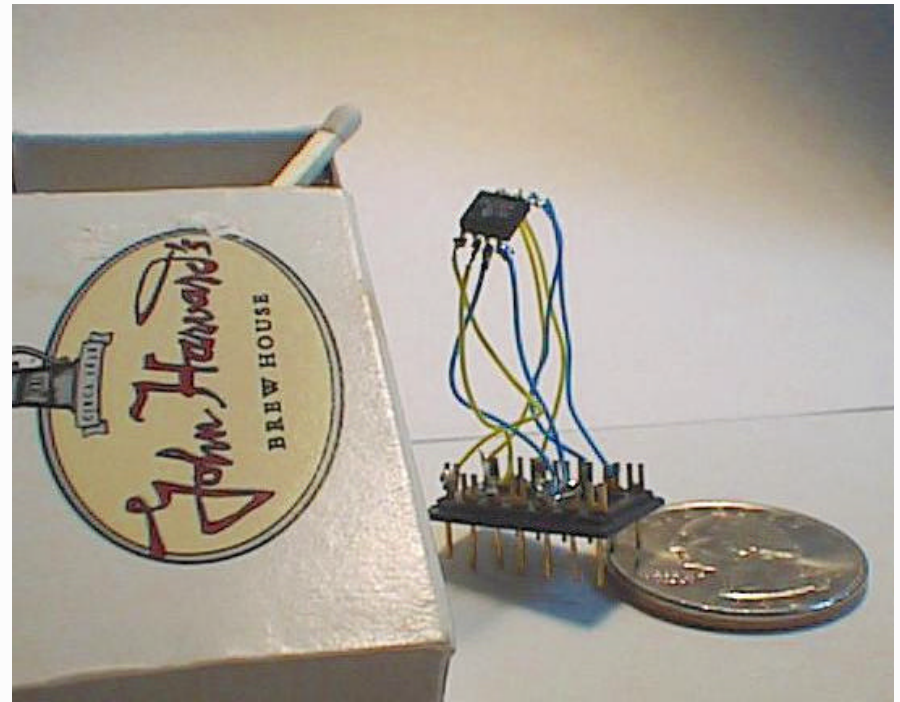
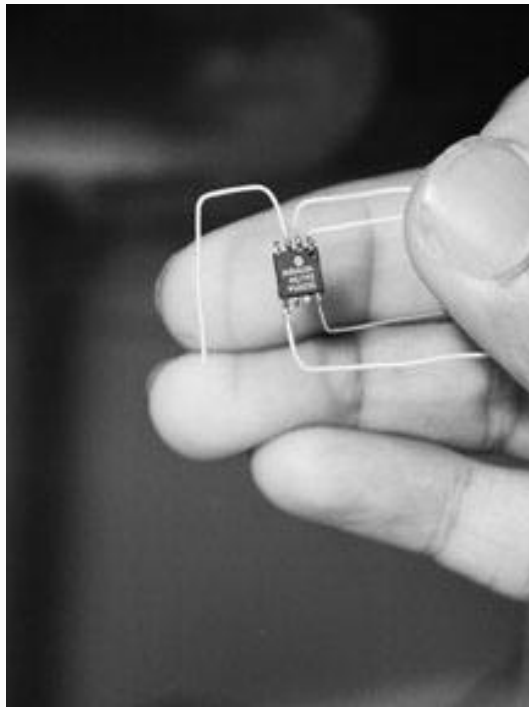
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Systems Integration

# Intelligent Buildings



Microminiaturization of Computer Equipment

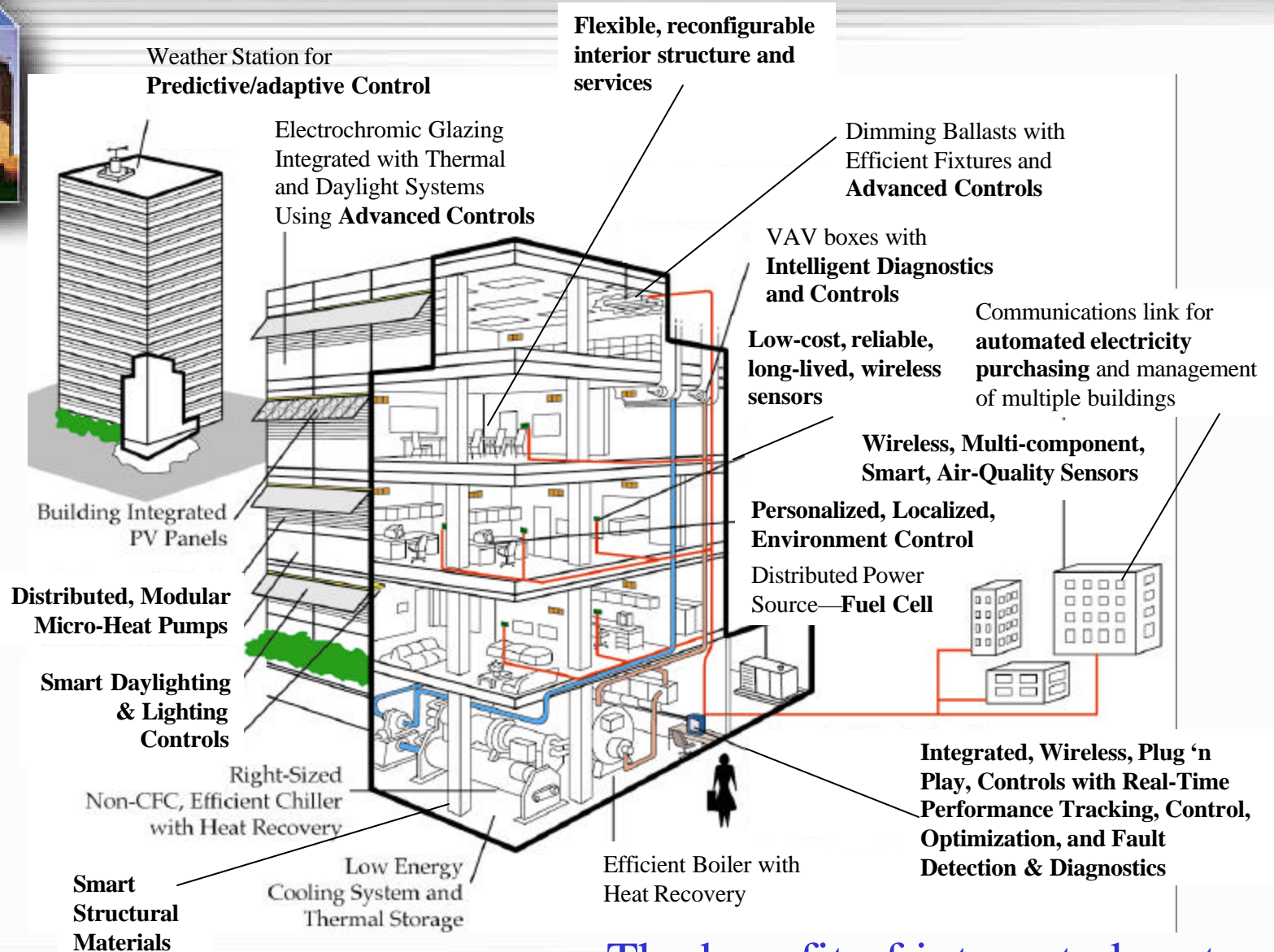
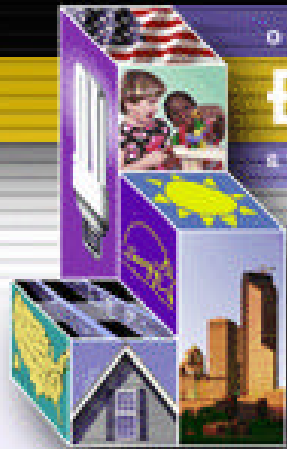


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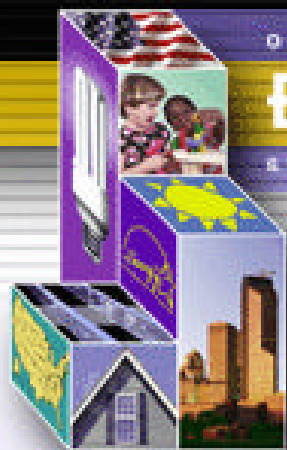
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## Systems Integration

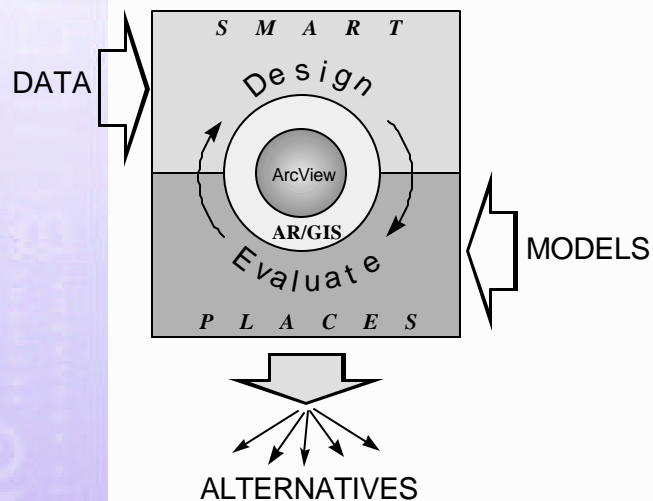


The benefit of integrated systems

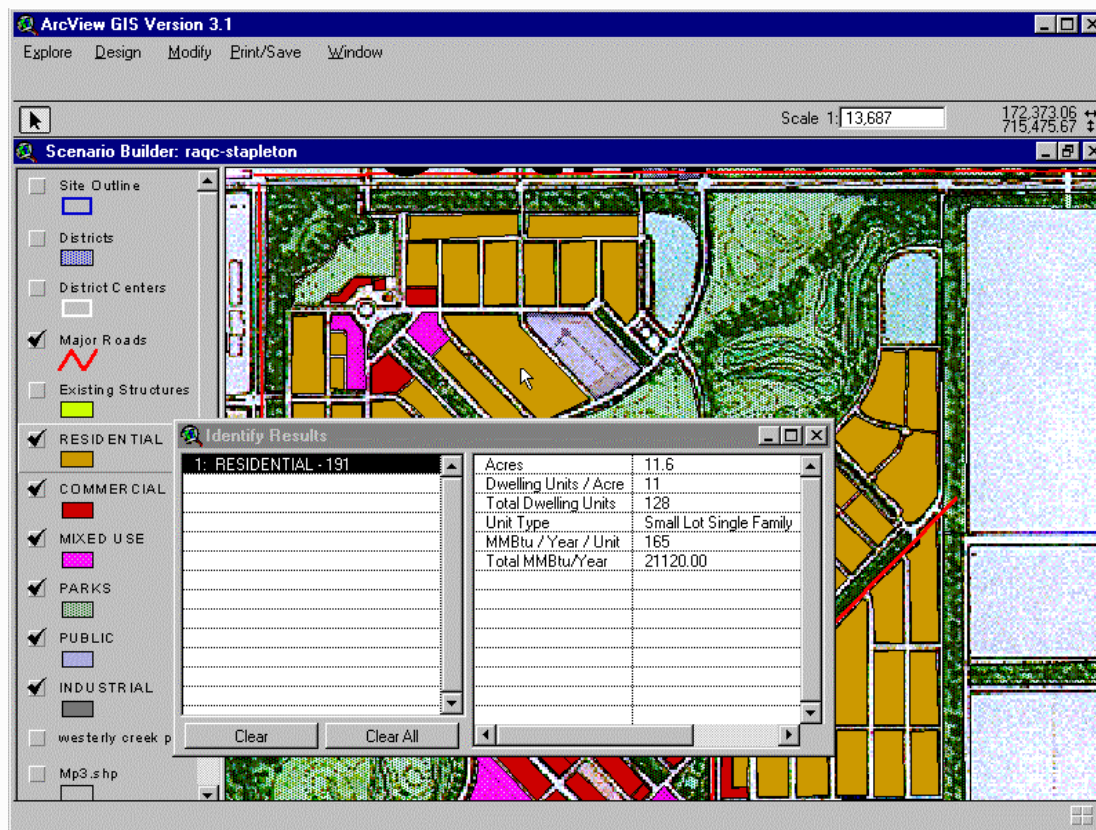


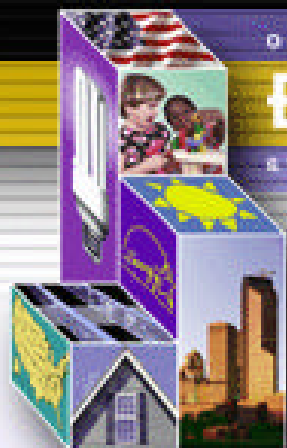


## Communities



PLACES<sup>3</sup>  
 design tool





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## Systems Integration

# Communities

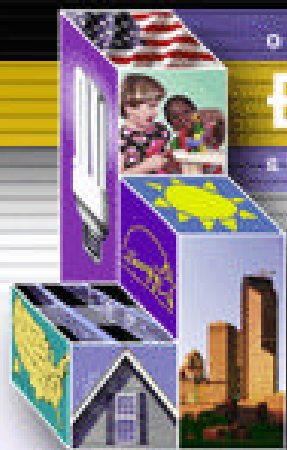
Historical and new communities can benefit from sustainable community design principles. So can military bases, parks, campus settings and hospital complexes.



Neighborhood Center at Civano

Village Green





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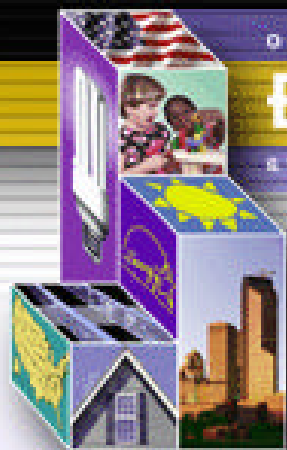
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# Technological Approaches

## Building Shell

- Passive Solar
- Insulation
- Windows



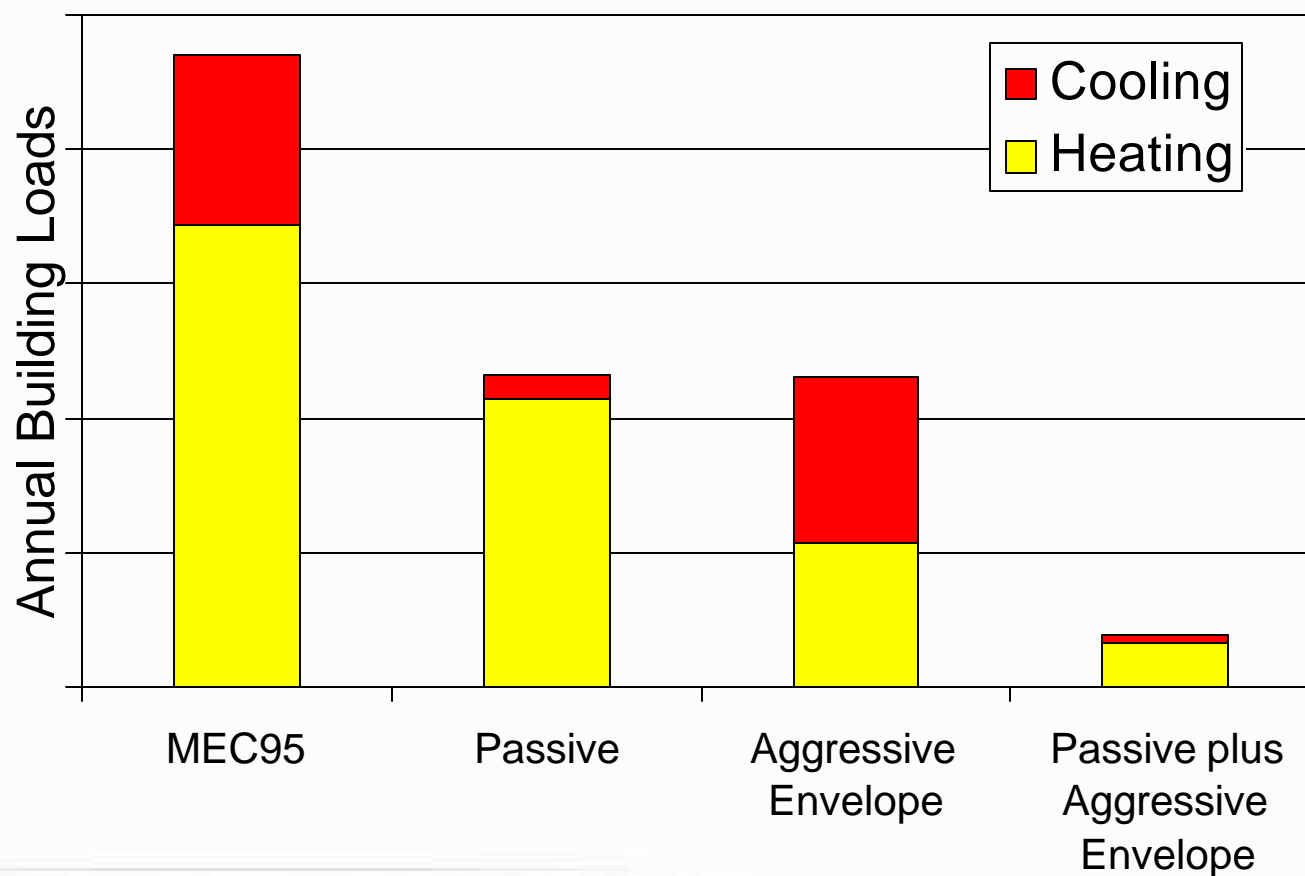
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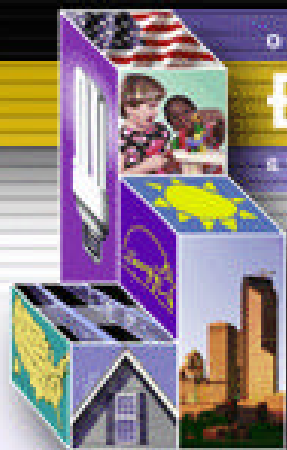
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Building Shell

## Envelope and Passive Solar Potential





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Building Shell

# Advanced Construction Methods and Materials

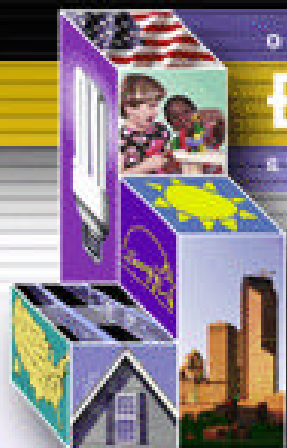


Modular Construction



Insulated Panels





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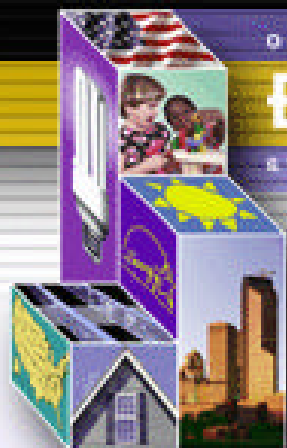
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Building Shell

## "Smart" Windows





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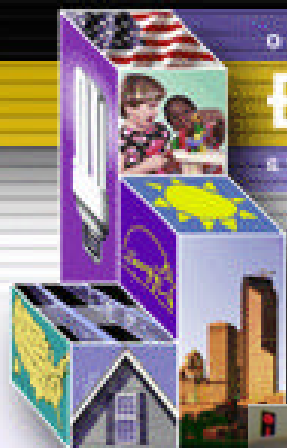
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# Technological Approaches

## Equipment

- Power Generation
- Space Conditioning
- Water Heating
- Advanced Refrigeration
- Lighting



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Equipment

## Power Generation



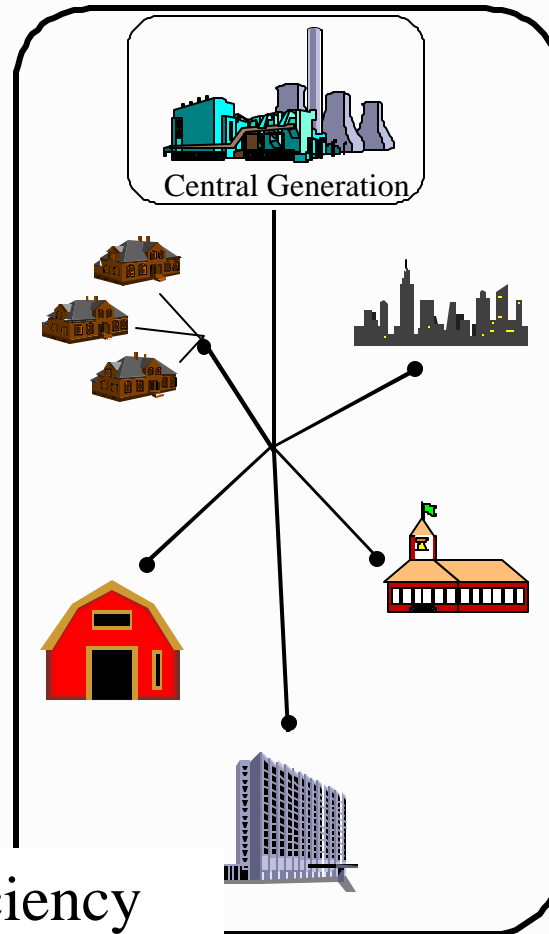
Buildings Combined Heat & Power Test Facility at Oak Ridge National Laboratory



Residential Fuel Cell (Plug Power LLC)

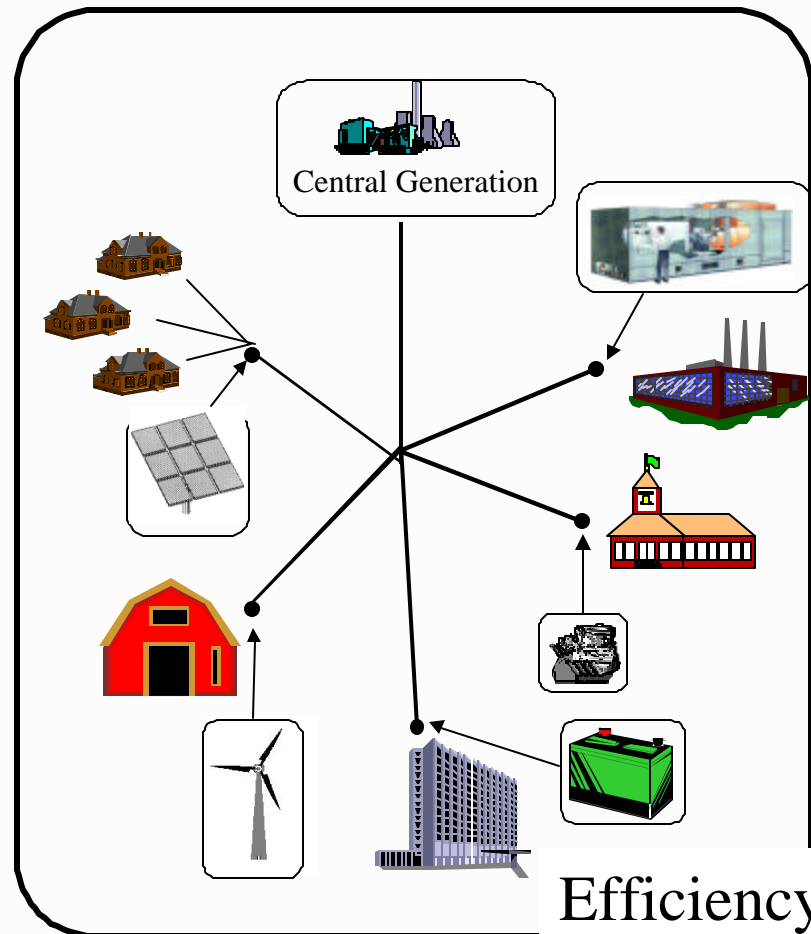


## Central Generation



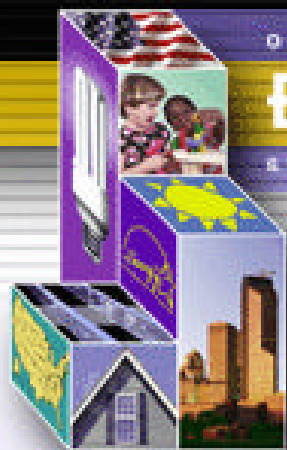
Efficiency  
35-50%

## Distributed Generation



Efficiency  
70-80%





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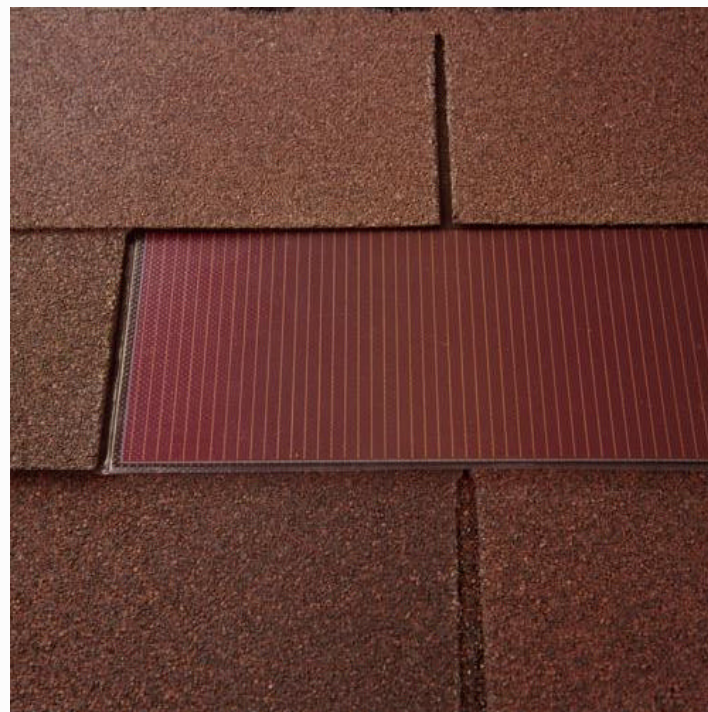
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Equipment

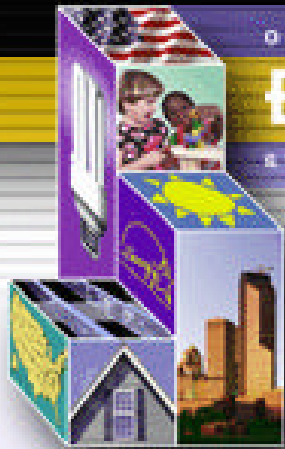
## Power Generation



Photovoltaics







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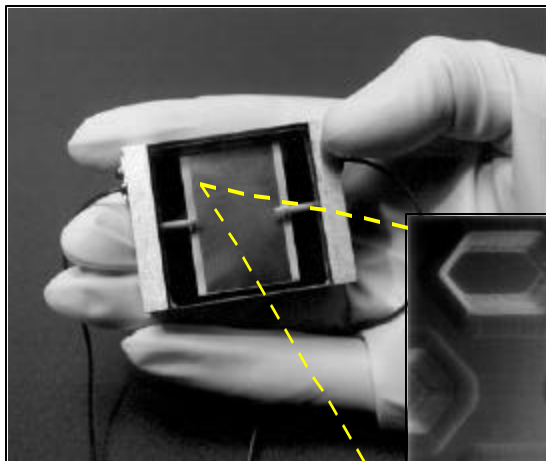
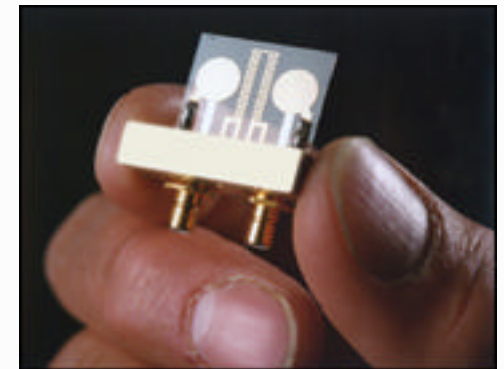
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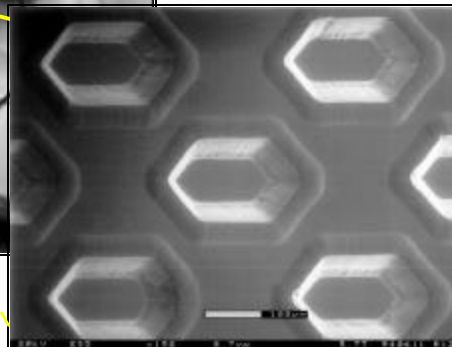
Equipment

# MicroElectroMagnetic Systems (MEMS)

Inexpensive  
combustion sensors  
and chemistry labs  
on a chip

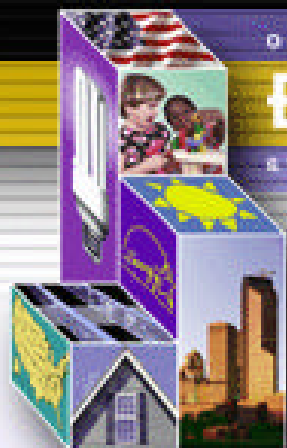


Compact Heat  
Exchangers

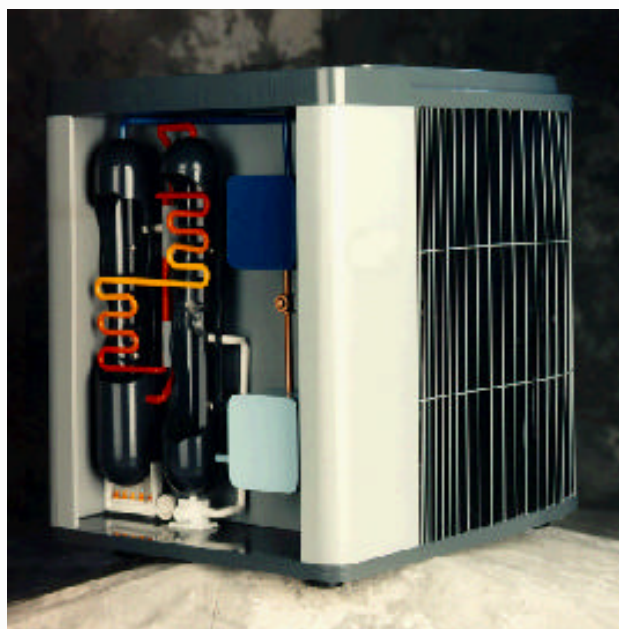


Active, adaptive surfaces  
to optimize performance





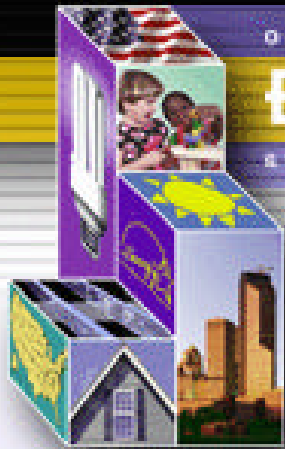
## Space Conditioning



Amonia-Water Residential  
Heat Pump



Desiccant Air  
Conditioning



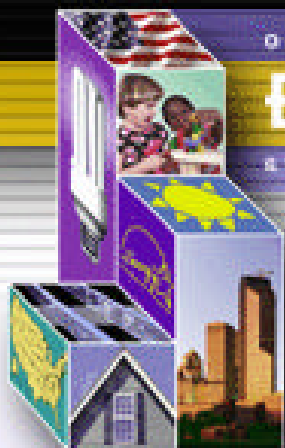
## Advanced Refrigeration



1 kWh/day Refrigerator



Vacuum Panel Freezer



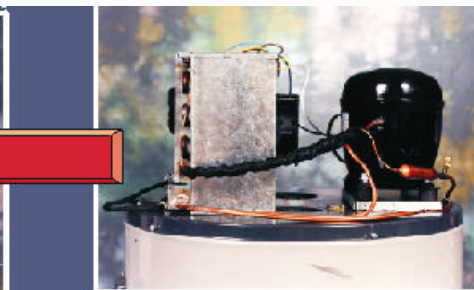
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Equipment

## Water Heating

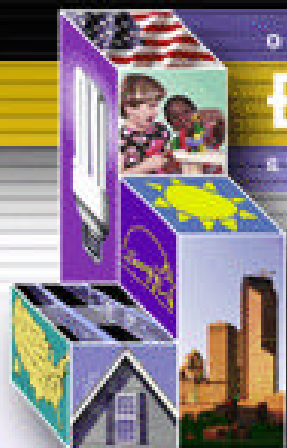


Residential  
Heat Pump  
Water Heater



Combined Refrigerator  
/Hot Water Heater (First  
Prototype)





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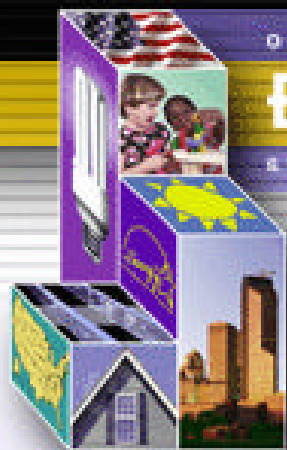
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## How Far Can This Concept Go?







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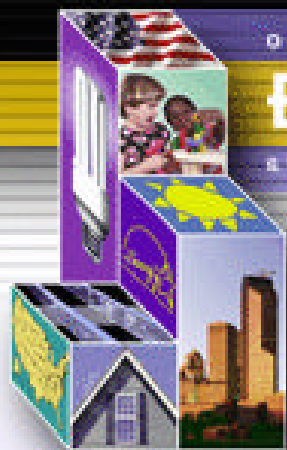
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Equipment

# Lighting



RADIANCE  
Lighting  
Design  
Software



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Equipment

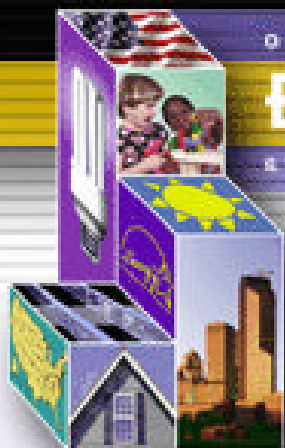
## Lighting



Solid State (LED) Lighting Sources



The Berkeley Lamp



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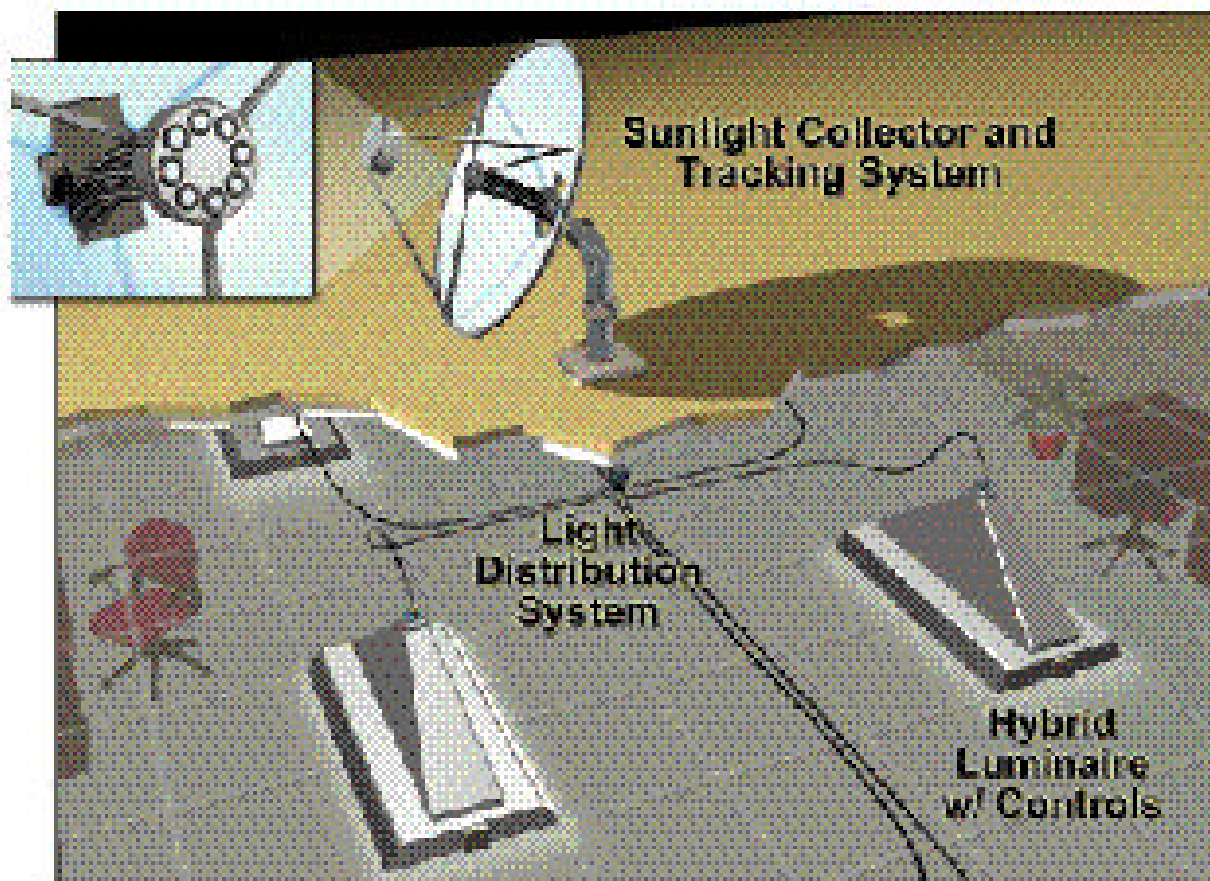
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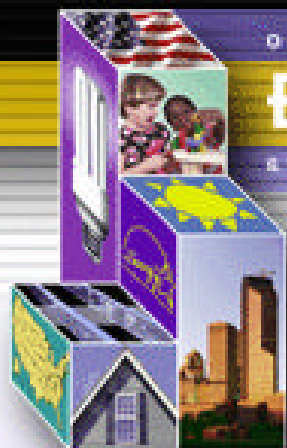
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Equipment

## Lighting

A solar  
lighting and  
power system





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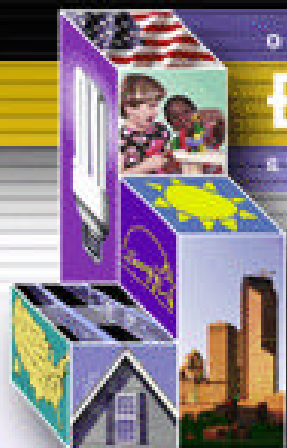
## Summary

**The technology revolution will make dramatic changes in the way we design, build, operate, and restore our buildings.**

**Results will be equally dramatic:**

- full appreciation of energy efficiency**
- clean, affordable new technologies**
- increased productivity and comfort**
- thousands of domestic jobs.**





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## How to Reach Me

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